Technical Information

RAYTHEON
TECHNICAL INFORMATION SERVICE

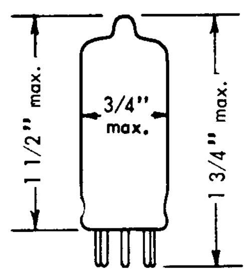
5725/6AS6W

MINIATURE DUAL-CONTROL PENTODE

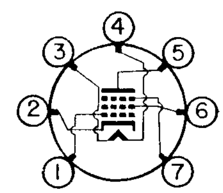
MECHANICAL DATA

ENVELOPE . . . . . . Glass T5½
OUTLINE 6–1
BASE . . . . Miniature Button 7-Pin
BASING 7CM
MOUNTING POSITION . . . . . Any
CATHODE . . . . Coated Unipotential

PHYSICAL DIMENSIONS



BASING



BOTTOM VIEW

TERMINAL CONNECTIONS:

Pin 1 Grid #1
Pin 2 Cathode, Shield
Pin 3 Heater
Pin 4 Heater
Pin 5 Plate
Pin 6 Grid #2
Pin 7 Grid #3

The 5725/6AS6W is a heater-cathode type pentode of miniature construction capable of operation in the UHF region. The control grid and suppressor grid may be used as independent control electrodes for circuits such as gated amplifiers, mixers, and gain controlled amplifiers. This tube is characterized by long life and stable performance. It is designed for service where severe conditions of high temperature and mechanical shock or vibration are encountered.

MECHANICAL RATINGS: (Maximum)

Impact Acceleration	450 G
Fatigue (Vibrational Acceleration for Extended Periods)	2.5 G
Bulb Temperature	165 °C
Altitude	80,000 ft.

ELECTRICAL DATA

Ratings and Normal Operation	MIL-E-1 Symbol	Test Limit or Design Minimum	Normal Test Conditions	Test Limit or Design Maximum	MIL-E-1 Units
Heater Voltage	Ef	5.7	6.3	6.9	V
Plate Voltage	Eb	---	120	200	Vdc
D.C. Grid Voltage	Ec1	–55	–2.0	0	Vdc
Screen Grid Voltage	Ec2	---	120	155	Vdc
Grid #3 Voltage	Ec3	–55	0	30	Vdc
Heater-Cathode Voltage	Ehk	–100	0	+100	v
Grid Resistance	Rg1	---	---	0.1	Meg.
Cathode Current	Ik	---	---	18	mAdc
Plate Dissipation	Pp	---	---	1.5	Watts
Grid Current	Ic1	---	---	0.9	mAdc
Screen Dissipation	Pg2	---	---	0.5	Watts
Grid #3 Current	Ic3	---	---	0.18	mAdc
			Tests		
Heater Current	If	160	175	190	mA
Plate Current	Ib	2.5	5.2	9.0	mAdc
Transconductance (1)	Sm	2500	3200	4500	μmhos
Heater-Cathode Leakage Ehk = ± 100 Vdc	Ihk	---	---	10	μAdc
Plate Current Ec1 = –3 Vdc Ec3 = –10 Vdc	Ib	---	---	200	μAdc
Plate Current Ec1 = –3 Vdc Ec3 = –6 Vdc	Ib	5	---	---	μAdc
Plate Current Ec1 = –8 Vdc	Ib	---	---	200	μAdc

RAYTHEON

5725/ 6AS6W

MINIATURE DUAL-CONTROL PENTODE

Ratings and Normal Operation	MIL-E-1 Symbol	Test Limit or Design Minimum	Normal Test Conditions	Test Limit or Design Maximum	MIL-E-1 Units
			Tests		
Plate Current Ec1 = -6 Vdc	Ib	5	---	---	μAdc
Screen Grid Current	Ic2	1.5	3.5	5.5	mAdc
Transconductance (2)	ΔEf/Sm	---	---	15	%
Transconductance (3) Ec3 = -3 Vdc	Sm (g3-p)	350	700	1050	μmhos
Transconductance (4) Ec3 -5 Vdc	Sm (g1-p)	700	1000	1700	μmhos
Interelectrode	Cg1-p	---	---	.02	μμf
Capacitances (Shield #316)	Cin Cout	3.5 2.6	4.0 3.0	4.5 3.4	μμf μμf
Vibration Rp = 10K; G = 10; f = 40 cps	Ep	---	---	150	mVac

SPECIAL TESTS AND RATINGS TO INSURE RELIABILITY.

Randomly selected statistical samples are subjected to the following tests.

Shock Test – 450 G. 30° hammer angle in Navy high impact shock machine. Sample subjected to twenty (20) impact accelerations, five impact accelerations in each of four different positions.

Fatigue Test – 2.5 G. Sample subjected to vibrational acceleration of 2.5 G for 96 hours (32 hours in each of three positions). The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Glass Strain – A sample is subjected to a forty-eight hour holding period at room temperature. The sample is immersed in water at 97–100°C for 15 seconds and immediately immersed in water at not more than 5°C for 5 seconds. The sample is then dried at room temperature for 48 hours and inspected for evidence of air leaks.

Heater Cycling Life Test – A sample is subjected to 2000 on–off heater cycles at the following conditions: Ef=7.5V; Ehk=+135 Vdc with all other elements floating. At the conclusion of this test, the tubes will not show open heater or cathode circuits or heater to cathode shorts.

Stability Life Test – Sample is operated for 2 + 20 hours to assure initial electrical stability. (Δ_t Sm < 10%). Tubes are operated with Eb = 180 Vdc, Ec2 = 125, Ec1 = 0, Ehk = +135 Vdc, Rk = 130 Ω and Rg1 = .1 meg.

Survival Rate Life Test – Sample is operated 100 hours to assure electrical stability (Sm > 2200 μmhos) and freedom from inoperatives. Tubes are operated under stability Life Test conditions.

Intermittent Life Test – 1000 hours. Sample is operated under Survival Rate Conditions with a minimum envelope temperature of 165°C.

Altitude – Sample is subjected to a pressure = 21 ± 2 mmHg (80,000 ft.) at 500 Vac to insure freedom from flashover or corona at the pins of the tube.

APPLICATION NOTES

CAUTION – – – To Electronic Equipment Design Engineers: Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions those than those specified for life test are imposed on the tube and will be reduced appreciably if maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are closely related to the degree that regulation of the heater voltage is maintained at its center rated value.

ACCEPTANCE CRITERIA

For purposes of acceptance inspection, use applicable reliable paragraphs.

Par. No.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Symbol	LIMITS (See Note 1) Min	LAL	Bogie	UAL	Max	ALD	Unit
GENERAL												
3.1	Qualification	Required for JAN marking	---	---	---	---	---	---	---	---	---	---
3.6	Performance		---	---	---	---	---	---	---	---	---	---
QUALIFICATION INSPECTION (see note 2)												
---	Cathode	Coated unipotential	---	---	---	---	---	---	---	---	---	---
3.4.3	Base Connections	E7–1	---	---	---	---	---	---	---	---	---	---
4.9.20.3	Variable frequency vibration (1)	Rp = 10,000	---	---	Ep	---	---	---	---	200	---	mVac
ACCEPTANCE INSPECTION, PART 1 (production) (see note 3)												
4.7.5	Continuity and short test (for reliable tubes)		0.4	II	---	---	---	---	---	---	---	---
4.9.1	Mechanical-production tests	Outline 6–1	---	---	---	---	---	---	---	---	---	---
4.10.4.1	Plate Current (1)		---	---	Ib	---	4.2	5.2	6.2	---	2.3	mAdc
4.10.4.1	† Plate Current (1)		0.4	II	Ib	2.5	---	---	---	9.0	---	mAdc
4.10.6.1	† Total Grid Current	Rg1 = 0.1 Meg (see note 4)	0.4	II	Ic1	0	---	---	---	–0.1	---	μAdc
4.10.8	Heater Current		---	---	If	---	168	175	182	---	14	mA
4.10.8	Heater Current		0.4	II	If	160	---	---	---	190	---	mA
4.10.9	Transconductance (1)		---	---	Sm	---	2900	3200	3500	---	750	μmhos
4.10.9	Transconductance (1)		0.4	II	Sm	2500	---	---	---	4500	---	μmhos
4.10.15	Heater–Cathode Leakage	Ehk = + 100 Vdc Ehk = –100 Vdc	0.4	II	Ihk Ihk	--- ---	--- ---	--- ---	--- ---	10 10	--- ---	μAdc μAdc
ACCEPTANCE INSPECTION, PART 2 (design)												
4.8	Insulation of electrodes	g1 – all g3 – all p – all	2.5	L6	R R R	100 100 100	--- --- ---	--- --- ---	--- --- ---	--- --- ---	--- --- ---	Meg Meg Meg
4.9.12.1	Low–pressure voltage breakdown	Pressure = 21 ± 2 mmHg; voltage = 500 Vac (see note 5)	6.5	(See note 6)	---	---	---	---	---	---	---	---
4.9.19.1	Low–frequency vibration (2)	Rp = 10,000; G = 10; F = 40 cps	6.5	Code I	Ep	---	---	---	---	150	---	mVac
4.10.3.1	Radio–frequency noise (other than shot–effect noise)	Ecal = 15.0 mVac; Ec1 = 0; Rk = 200; Ck = 0.2 μf (see note 7)	2.5	I	---	---	---	---	---	---	---	---

Par. No.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Symbol	LIMITS (See Note 1)						Unit
						Min	LAL	Bogie	UAL	Max	ALD	
ACCEPTANCE INSPECTION, PART 2 (design) (cont.)												
4.10.3.4	Noise and micro-phonics (for reliable receiving tubes)	Ef = 6.3 Vac; Ebb = 200 Vdc; Ecc2 = 200 Vdc; Ec1 = 0; Ecal = 175 mVac; Rk = 1,000; Rp = 0.1 Meg; Rg2 = 0.5 Meg; Cg2 = 2 µf; Ck = 1,000 µf min (see note 8)	2.5	I	---	---	---	----	---	---	---	---
4.10.4.1	Plate Current (2)	Ec1 = –3 Vdc; Ec3 = –10 Vdc	2.5	I	Ib	---	---	---	---	200	---	µAdc
4.10.4.1	Plate Current (3)	Ec1 = –3 Vdc; Ec3 = –6 Vdc	2.5	I	Ib	5	---	---	---	---	---	µAdc
4.10.4.1	Plate Current (4)	Ec1 = –8 Vdc	2.5	I	Ib	---	---	---	---	200	---	µAdc
4.10.4.1	Plate Current (5)	Ec1 = –6 Vdc	2.5	I	Ib	5	---	---	---	---	---	µAdc
4.10.4.3	Screen–Grid Current		2.5	I	Ic2	1.5	---	---	---	5.5	---	mAdc
4.10.6.2	Grid Emission	Ef = 7.5 V; Ec1 = –10 Vdc; Rg1 = 0.1 Meg; (see note 9)	2.5	I	Isc	0	---	---	---	–1.0	---	µAdc
4.10.9	Transconductance (2)	Ef = 5.7 V	2.5	I	ΔSm Ef	---	---	---	---	15	---	%
4.10.9	Transconductance (3)	Ec3 = –3 Vdc	6.5	L6	Sm (g3-p)	350	---	---	---	1050	---	µmhos
4.10.9	Transconductance (4)	Ec3 = –5 Vdc	6.5	L6	Sm (g1-p)	700	---	---	---	1700	---	µmhos
4.10.14	Direct Interelec-trode capacitance	Shield No. 316 Shield No. 316 Shield No. 316	6.5	Code E	Cg1p Cin Cout	--- 3.5 2.6	--- --- ---	--- --- ---	--- --- ---	0.02 4.5 3.4	--- --- ---	µµf µµf µµf
ACCEPTANCE INSPECTION, PART 3 (degradation rate) (see note 10)												
4.9.6.1	Miniature-tube base-strain		---	---	---	---	---	---	---	---	---	---
4.9.6.3	Glass strain (for receiving tubes)		2.5	I	---	---	---	---	---	---	---	---
4.9.20.5	Shock test	Hammer angle = 30°; Ehk = +100 Vdc (see note 11)	---	---	---	---	---	---	---	---	---	---
4.9.20.6	Fatigue test	G = 2.5; fixed frequency; F = 25 min. 60 max.	6.5	(See Note 6)	---	---	---	---	---	---	---	---
---	Post shock and fatigue test end points	Vibration (2) Heater-cathode leakage Ehk = +100 Vdc Ehk = –100 Vdc Transconductance (1) Grid Current	--- --- --- --- ---	--- --- --- --- ---	Ep Ihk Ihk Sm(1) Ic1	--- --- --- 2200 0	--- --- --- --- ---	--- --- --- --- ---	--- --- --- --- ---	300 30 30 --- –0.4	--- --- --- --- ---	mVac µAdc µAdc µmhos µAdc

Par. No.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Allowable Defects per Characteristic		Symbol	LIMITS		Unit
					First Sample	Combined Samples		Min.	Max.	
ACCEPTANCE INSPECTION, PART 3 (life) (see note 10)										
4.11.7	Heater–cycling life test	Ef = 7.5 V; Ehk = +135 Vdc; Ecl = Ec2 = Ec3 = Eb = 0 (see note 12)	---	---	---	---	---	---	---	---
4.11.4	Life–test end points (heater–cycling)	Heater–cathode leakage								
		Ehk = +100 Vdc	---	---	---	---	Ihk	---	20	μAdc
		Ehk = –100 Vdc	---	---	---	---	Ihk	---	20	μAdc
4.11.3.1(a)	Stability life test	Eb = 180 Vdc; Ec1 = 0; Ec2 = 125 Vdc; Ehk = +135 Vdc; Rk = 130; Rg1 = 0.1 meg; TA = room (see note 13)	1.0	Code I	---	---	---	---	---	---
4.11.4	Life–test end points (stability) (2 and 20 hours)	Change in transconductance(1) of individual tubes	---	---	---	---	Δ_tSm	---	10	%
4.11.3.1(b)	Survival–rate life test	Stability life test conditions, or equivalent (see notes 14 and 15)	---	II	---	---	---	---	---	---
4.11.4	Life–test end points (survival rate) (100 hours)	Continuity and short (inoperatives)	0.65	---	---	---	---	---	---	---
		Transconductance(1)	1.0	---	---	---	Sm	2200	---	μmhos
4.11.5	Intermittent life-test operation	Stability life test conditions; TE = +165° C min. (see notes 16 and 17)	---	---	---	---	---	---	---	---
4.11.4	Life–test end points (intermittent) (500 hours)	(See note 18)								
		Inoperatives (see note 19)	---	---	1	3	---	---	---	---
		Grid current	---	---	1	3	Ic1	0	–0.1	μAdc
		Heater current	---	---	1	3	If	160	190	mA
		Change in transconductance(1) of individual tubes	---	---	1	3	Δ_tSm	---	20	%
		Transconductance(2)	---	---	1	3	Δ_{Ef}Sm	---	15	%
		Heater-cathode leakage								
		Ehk = +100 Vdc	---	---	1	3	Ihk	---	10	μAdc
		Ehk = –100 Vdc					Ihk	---	10	μAdc
		Insulation of electrodes								
		g1 – all					R	50	---	Meg
		g3 – all	---	---	1	3	R	50	---	Meg
		p – all					R	50	---	Meg
		Transconductance(1) average change	---	---	---	---	AvgΔ_tSm	---	15	%
		Total defectives	---	---	3	6	---	---	---	---

Par. No.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Allowable Defects per Characteristic: First Sample	Allowable Defects per Characteristic: Combined Samples	Symbol	LIMITS: Min.	LIMITS: Max.	Unit
ACCEPTANCE INSPECTION, PART 3 (life) (see note 10) (cont.)										
4.11.4	Life-test end points (intermittent) (1,000 hours)	(See note 18)								
		Inoperatives (see note 19)	---	---	1	3	---	---	---	---
		Grid current	---	---	1	3	Ic1	0	-0.1	µAdc
		Heater current	---	---	1	3	If	160	190	mA
		Change in transconductance(1) of individual tubes	---	---	1	3	Δ_tSm	---	25	%
		Transconductance(2)	---	---	1	3	Δ_{Ef}Sm	---	20	%
		Heater-cathode leakage								
		Ehk = +100 Vdc	---	---	1	3	Ihk	---	10	µAdc
		Ehk = -100 Vdc					Ihk	---	10	µAdc
		Insulation of electrodes								
		g1 - all					R	40	---	Meg
		g3 - all	---	---	1	3	R	40	---	Meg
		p - all					R	40	---	Meg
		Total defectives	---	---	4	8	---	---	---	---
4.9.18	Container drop	Required								
5.	Preparation for delivery	(See note 20)								

Note 1: Variables sampling procedure: See 4.1.1.7

Note 2: All tests listed hereon shall be performed during qualification inspection; however, these three tests are normally performed during qualification inspection only.

Note 3: The AQL for the combined defectives for attributes in acceptance inspection, part 1 (production), excluding inoperatives and mechanical, shall be 1 percent.

Note 4: Approved alternate test: The insertion of a 1.0-megohm resistor in the grid circuit shall change the plate current by not more than 0.5 mAdc.

Note 5: Socket need not be used in performing this test.

Note 6: This test shall be conducted on the initial lot and thereafter on a lot approximately every 30 days. When one lot has passed, the 30-day rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lots shall be subjected to this test until a lot passes. Standard MIL-STD-105, sample size code letter F shall apply.

Note 7: In addition to the rejection criteria of 4.10.3.1, the output shall be read on a VU meter using a rejection limit of 5 VU. Five VU is the meter deflection obtained with a steady-state output of 3 mW from the amplifier.

Note 8: The rejection limit shall be set at the VU meter reading obtained during calibration.

Note 9: Prior to this test, the tube shall be preheated a minimum of 5 minutes at the conditions indicated below. The 3-minute test is not permitted. Test at specified conditions within 3 seconds after preheating. Grid emission shall be the last test performed on the sample selected for the grid emission test.

Ef	Ec1	Ec2	Ec3	Eb	Rk	Rg1
V	Vdc	Vdc	Vdc	Vdc	ohms	Meg
7.5	0	125	0	180	130	0.1

Note 10: Destructive tests: Tubes subjected to the following destructive tests are not to be delivered on the contract or order:

- 4.9.20.5 Shock test
- 4.9.20.6 Fatigue test
- 4.11.7 Heater-cycling life test
- 4.11.5 Intermittent life-test operation.

Note 11: A grid No. 1 resistor of 0.1 megohm shall be added; however, this resistor shall not be used when a thyratron-type short indicator is employed.

Note 12: The no-load to steady-state full load regulation of the heater voltage supply shall be not more than 3.0 percent. This test shall be made on a lot-by-lot basis.

Note 13: Stability life test: See 20.2.5.1 of Appendix C.

Note 14: Survival-rate life test: The sampling and testing procedures for this test shall be as specified in 20.2.5.2 to 20.2.5.2.4, inclusive, of Appendix C, with the following exceptions:

20.2.5.2.3: Replace second sentence with the following: If such selection results in a sample containing one or more tubes which are defective as defined under 4.7.5, such tubes shall be replaced by randomly selected good tubes.

20.2.5.2.4(b): Replace with the following: Tubes shall be tested at 100 hours for continuity and short (inoperative) under the same conditions as for the initial test. When any tap-short indication is obtained, the test shall be repeated. When any short indication is again obtained, the tube shall be rejected as inoperable.

Note 15: For survival-rate life test, the equivalent stability life-test conditions shall be as specified in 20.2.5.2.5 of Appendix C.

Note 16: Intermittent life tests: See 20.2.5.3 of Appendix C.

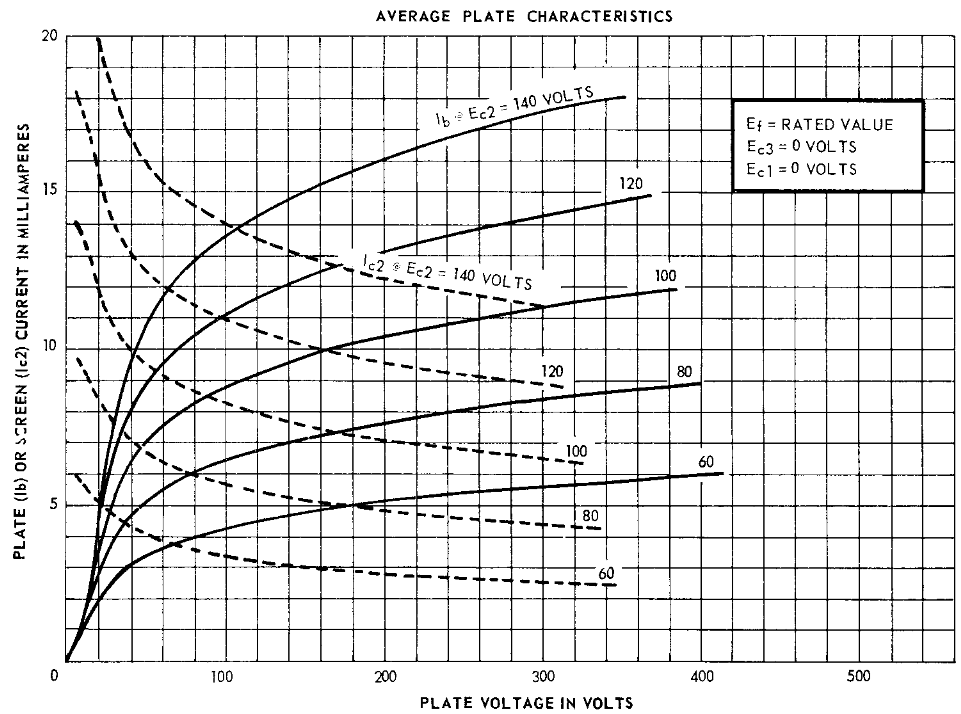
Note 17: Envelope temperature is defined as the highest temperature indicated when using a thermocouple of No. 40 B & S or smaller diameter elements welded to a ring of 0.025-inch diameter phosphor bronze in contact with the envelope. The envelope temperature requirement will be satisfied if a tube, having bogie plate current (±5 percent) under normal test conditions, is determined to operate at or above the minimum specified temperature at any position on the life-test rack.

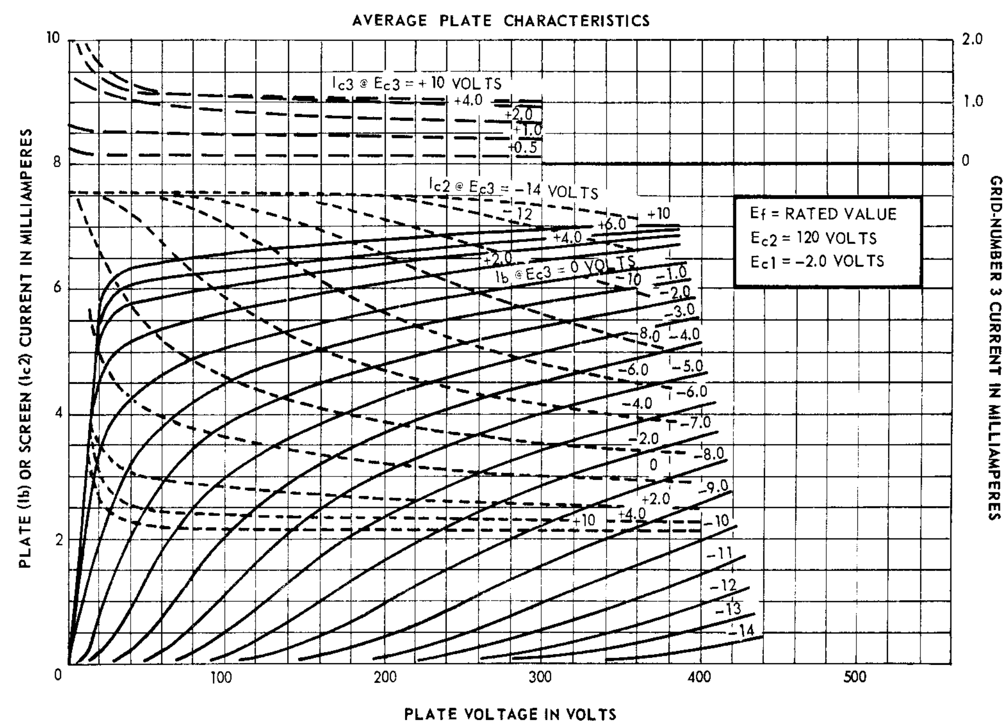
Note 18: Order for evaluation of life-test defects: See 4.11.3.1.2

Note 19: An inoperative, as referenced in life test, is defined as a tube having one or more of the following defects: discontinuity or permanent short (see 4.7.5, except tube shall not be tapped); air leaks (see 4.7.6).

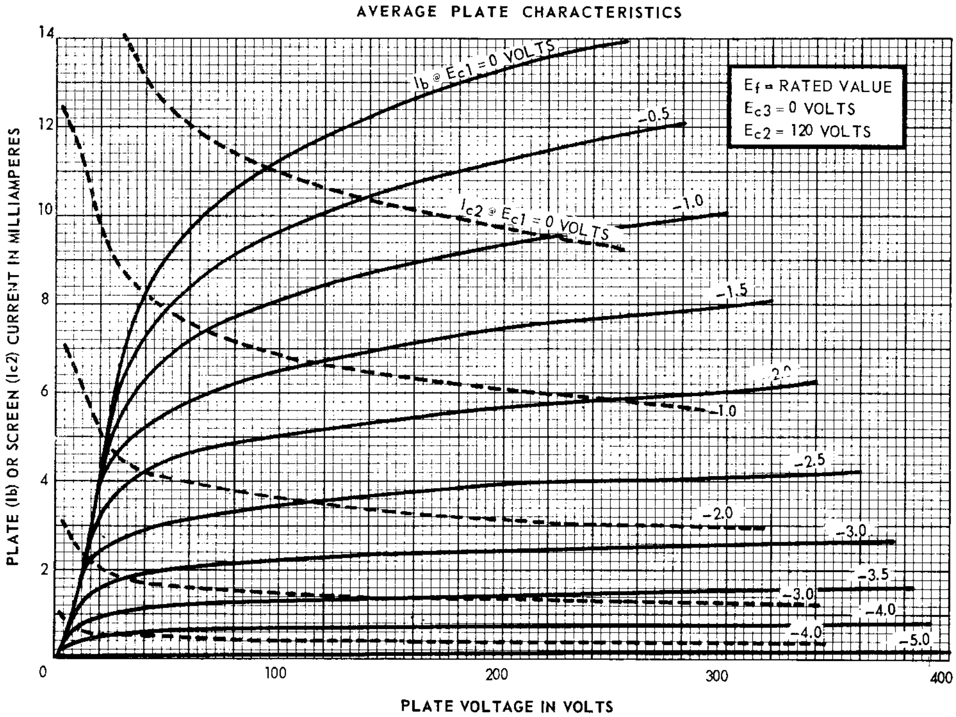
Note 20: Tubes shall be prepared for domestic or overseas shipment, as specified in the contract or order, in accordance with Specification MIL-E-75 and appendix thereto.

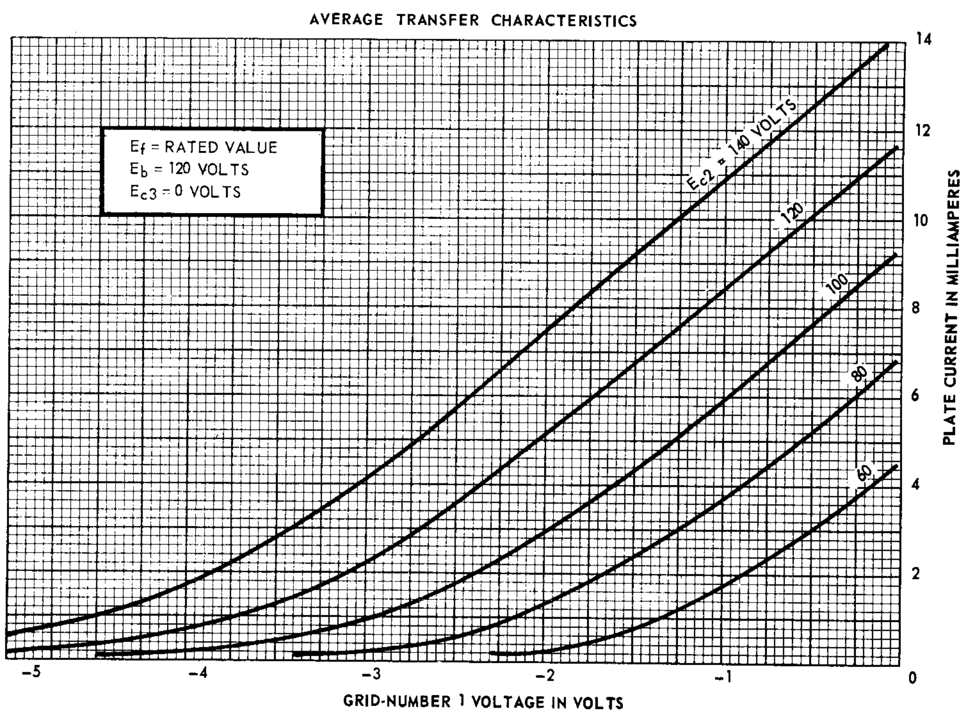
Note 21: All production lots shall be suitably identified.


AVERAGE PLATE CHARACTERISTICS
I_b @ E_{c2} = 140 VOLTS
120
100
80
60
I_{c2} @ E_{c2} = 140 VOLTS
120
100
80
60
E_f = RATED VALUE
E_{c3} = 0 VOLTS
E_{c1} = 0 VOLTS
PLATE (Ib) OR SCREEN (Ic2) CURRENT IN MILLIAMPERES
PLATE VOLTAGE IN VOLTS

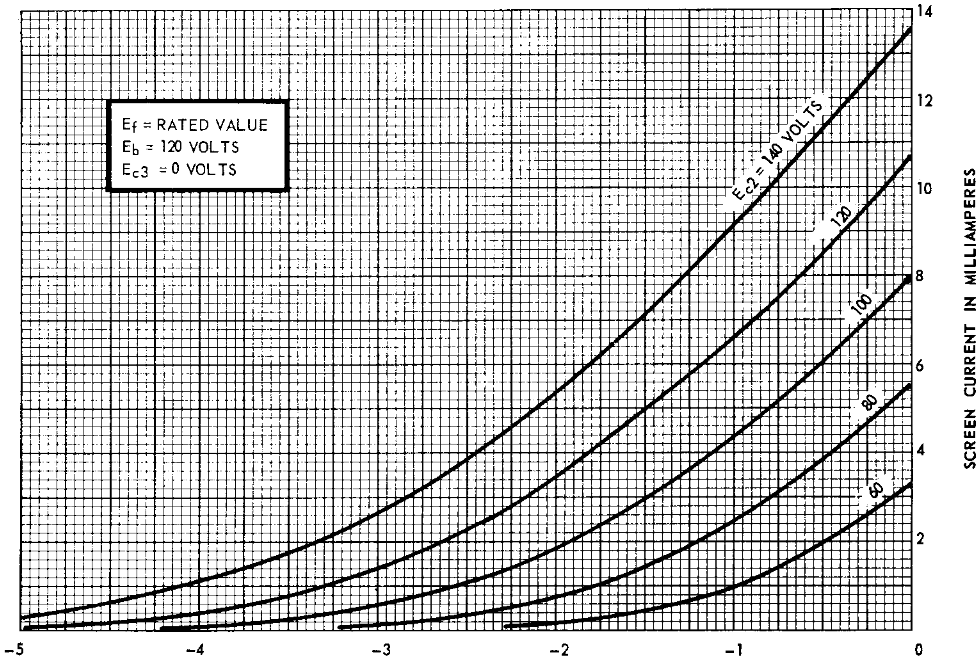

AVERAGE PLATE CHARACTERISTICS
I_{c3} @ E_{c3} = +10 VOLTS
+4.0
+2.0
+1.0
+0.5
I_{c2} @ E_{c3} = −14 VOLTS
I_b @ E_{c3} = 0 VOLTS
E_f = RATED VALUE
E_{c2} = 120 VOLTS
E_{c1} = −2.0 VOLTS
PLATE (Ib) OR SCREEN (Ic2) CURRENT IN MILLIAMPERES
GRID-NUMBER 3 CURRENT IN MILLIAMPERES
PLATE VOLTAGE IN VOLTS

MINIATURE DUAL-CONTROL PENTODE

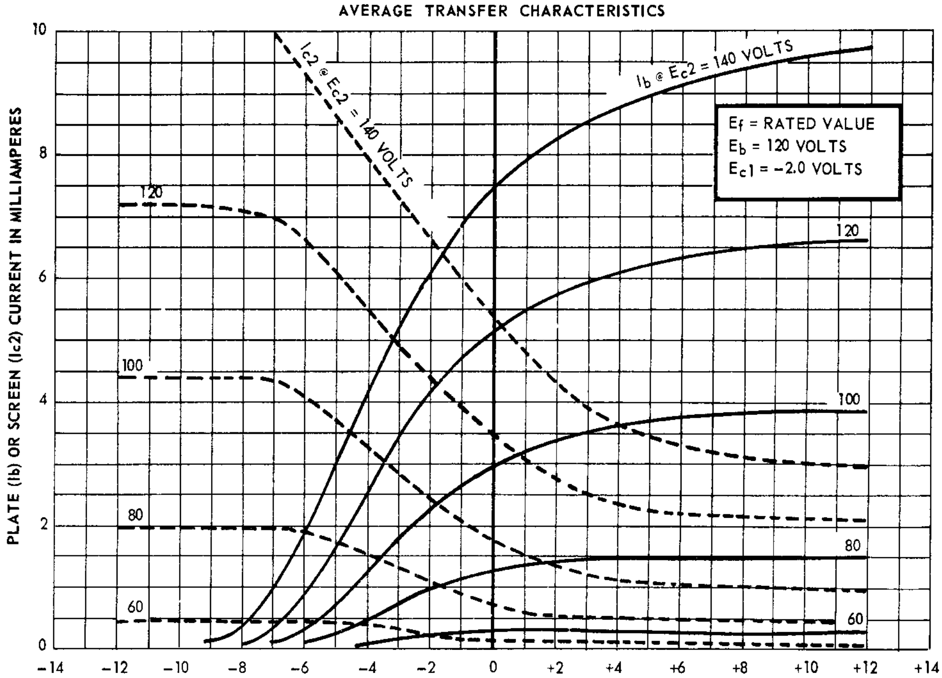




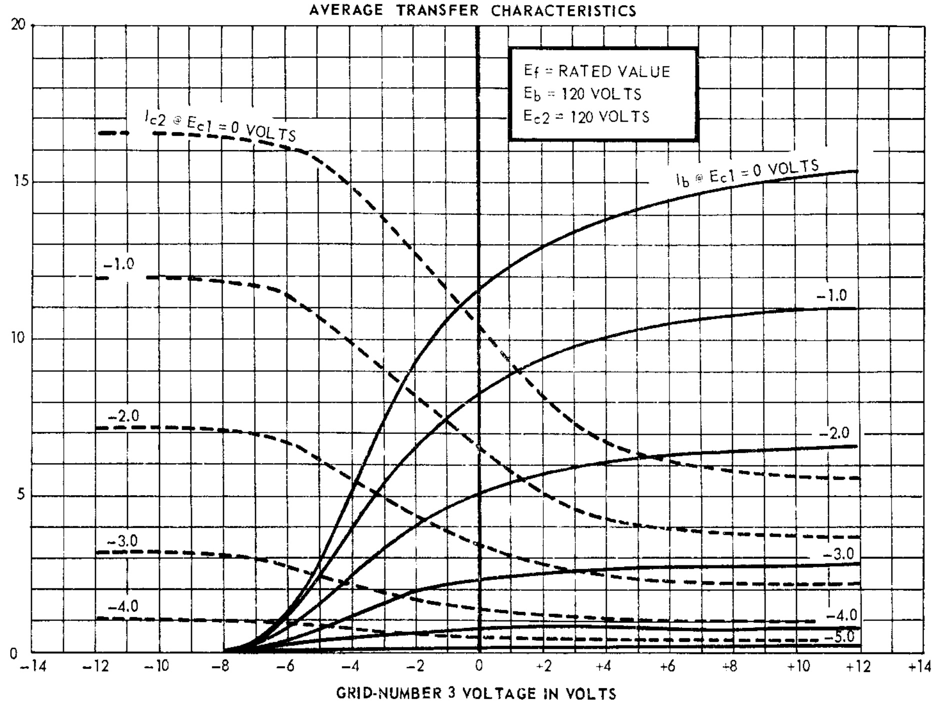
AVERAGE TRANSFER CHARACTERISTICS

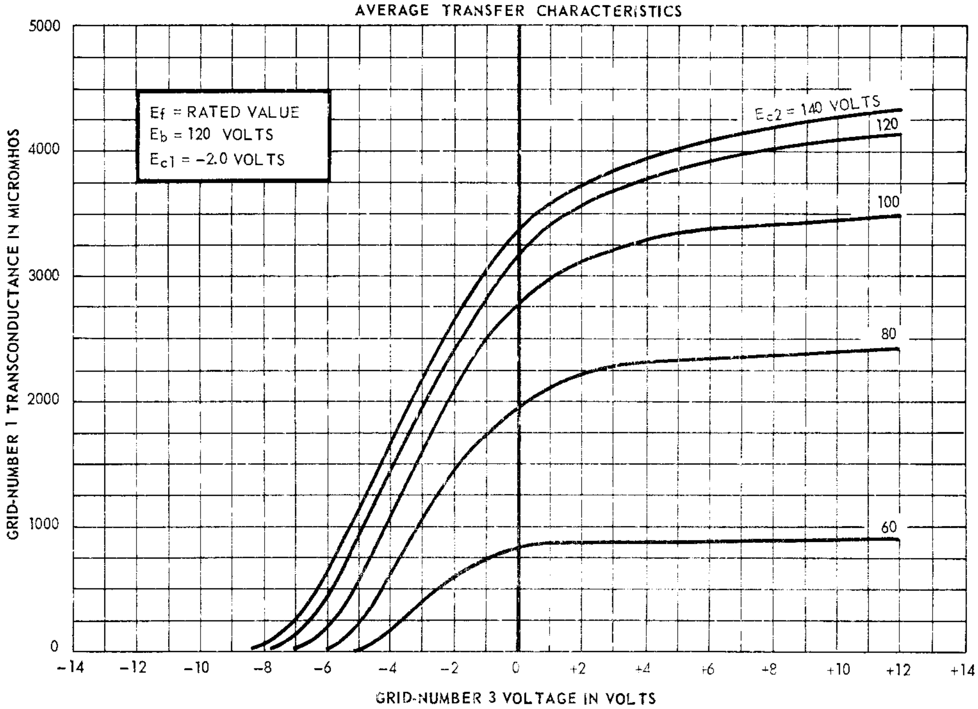


AVERAGE TRANSFER CHARACTERISTICS

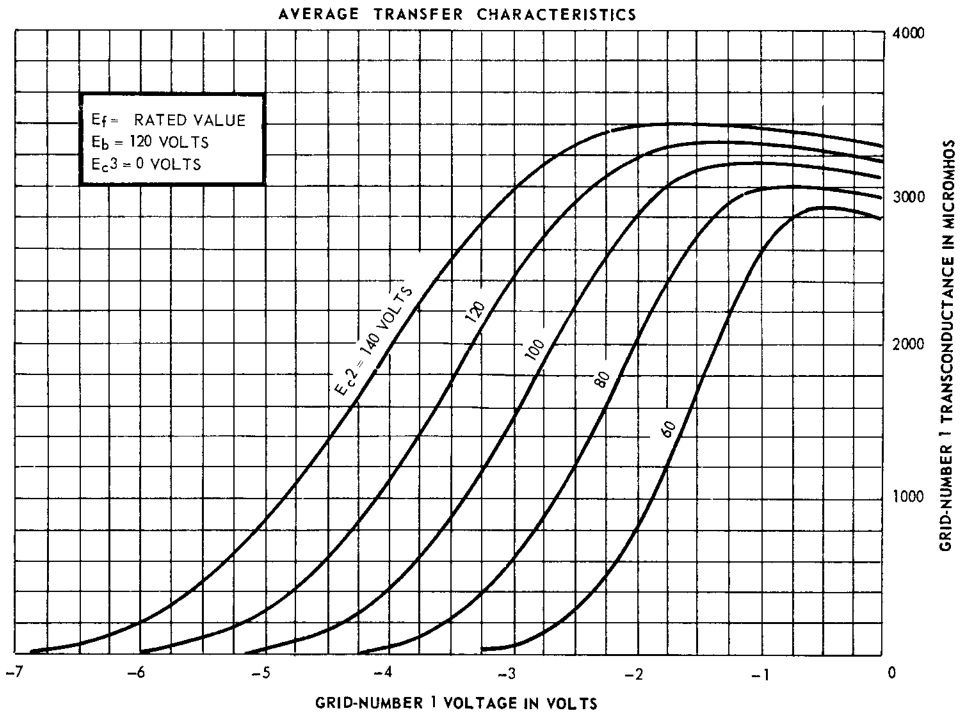


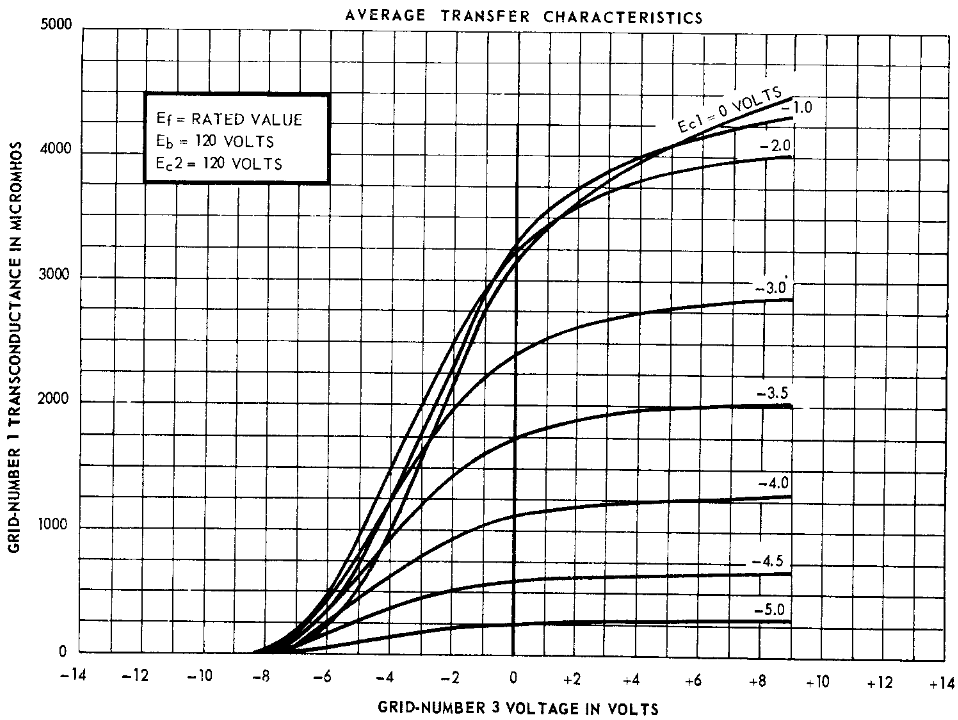
MINIATURE DUAL-CONTROL PENTODE





MINIATURE DUAL-CONTROL PENTODE

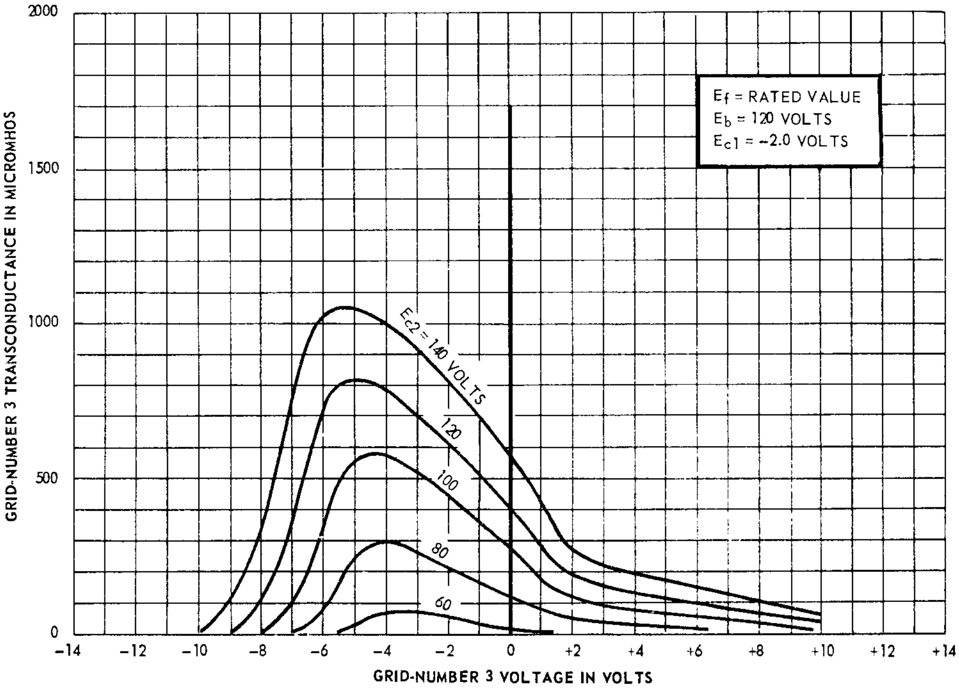




RAYTHEON COMPANY · 55 Chapel Street · Newton 58, Massachusetts

MINIATURE DUAL-CONTROL PENTODE

AVERAGE TRANSFER CHARACTERISTICS



AVERAGE TRANSFER CHARACTERISTICS

